

## On some species of *Micrasterias*.

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WITH PLATE VI.

The genus which forms the subject of these notes includes some of the largest and most beautiful of the Desmidiæ. During the past summer the writer has had an opportunity of studying an abundance of material of a number of species, including one or two rare forms. Some of the facts noted do not appear to have been previously recorded, though apparently of considerable importance. Most of the material was collected on Long Island, in several large ponds, at Cold Spring Harbor.

Probably the most interesting find was *Micrasterias foliacea* Bailey. This was very abundant in one gathering made by rinsing waterweeds. The species was first described by Prof. Bailey, in 1847, in a letter to Ralfs, and was published and figured by the latter in his *British Desmidiæ*.<sup>1</sup> It is apparently not a common species, though widely distributed. It has been reported from Burmah by Joshua,<sup>2</sup> from Bengal by Wallich,<sup>3</sup> from Java by Nordstedt. In this country Welle found it once or twice,<sup>4</sup> but no one else appears to have reported it since Bailey's original discovery. Prof. Nordstedt has described<sup>5</sup> a variety *ornata*, from Brazil, differing from the type only in having, on the superior margin of the intermediate lobe and the inferior of the basal lobe, two small aculei.

In the material studied the cells are usually found joined end to end in long ribbon-like chains (fig. 1), though single cells are not uncommon. In some cases over a hundred cells were counted in a single filament, and the number appears to be limited only by the strength of the connection of the cells and the strain put upon it. Wallich appears to have been the

<sup>1</sup>The *British Desmidiæ*. 210. *pl.* 35. *f.* 3. 1848.

<sup>2</sup>Burmese *Desmidiæ*, *Journal of the Linnean Soc.* 21: 636. 1886.

<sup>3</sup>Description of *Desmidiæ* from lower Bengal. *Ann. and Mag. of Nat. Hist.* III. 5: 280. *pl.* 14. *f.* 1-3.

<sup>4</sup>*Bulletin of Torrey Botanical Club* 9: 27. 1882. *Desmids of the United States*, 118. *pl.* 38. *f.* 10, 11. 1884.

<sup>5</sup>*Symbolæ ad floram Brazilæ centralis cognoscendam. Particula quinta. Desmidiaceæ. Vidensk. Medd. fra den naturh. Forening i Kjöbenhavn* 221. *pl.* 2. *f.* 16. 1869.

first to notice the union into filaments.<sup>6</sup> Wolle found the filaments, and states<sup>7</sup> that the cells are held together by the overlapping of the end lobes.

It is in connection with the form of this end lobe, and the means by which the cells are joined that the descriptions by various authors are most indefinite or confused. The figure in Ralfs' *British Desmidiæ* is very defective, and justifies Wallich's remark that neither Bailey nor Ralfs seems to have noticed the minute details of structure. Wallich describes the form which he found as *var. β*, but it seems scarcely distinct from the type. He describes it as emarginate, with one spine on each surface, the two being diagonally opposite. He figures a chain of three cells, but they could not possibly be joined in the manner represented by him.

Rabenhorst<sup>8</sup> mentions the species as one not yet found in Europe, and states that the emarginate polar lobe is bidentate on each surface. Later writers seem to have followed him, and the statement is true, as far as it goes. The best figures of the terminal lobe are given by Nordstedt,<sup>9</sup> but there are some points not made clear by his plate and description.

The form of a single cell is shown by the accompanying drawing (figs. 2 and 3). The lateral margins of the frond are nearly straight and parallel, and the end lobe projects but slightly beyond them. This lobe is deeply emarginate, with an almost rectangular sinus. The portion on each side of the sinus is depressed on one surface, in such a way that the two depressions lie diagonally opposite each other. This is very difficult to describe, but may be easily understood by reference to the drawings. At the base of the sinus on either surface of the frond are two tooth-like projections. These have been often noticed before, but one peculiarity seems to have been overlooked. The tooth on the side adjoining the depression is nearly twice as large as the other. An examination of hundreds of specimens shows this to be constant.

The manner in which the cells are joined in the filament may be seen from fig. 4. The lower cell is slightly separated from the next, showing the manner in which the lateral portions of the end lobes of the two fronds are dovetailed to-

<sup>6</sup>Loc. cit.

<sup>7</sup>*Desmids of the United States*, 118.

<sup>8</sup>*Flora Europæa Algarum aquæ dulcis et submarinæ*. 3: 195. 1868.

<sup>9</sup>Loc. cit.

gether. When the cells fit closely together the projecting teeth interlock. It would be difficult to imagine a more rigid connection than this. The firmness of the union and the shape of the cells give the filaments little flexibility, and they are usually nearly straight.

Unfortunately it was impossible to work out the development of the terminal lobe, as no specimens were found undergoing division.

*Micrasterias pinnatifida* (Kütz.) Ralfs was another species studied. This is closely related to *M. oscitans* Ralfs, if indeed it is not merely a variety of that species. It was first described by Kützing<sup>10</sup> as *Euastrum pinnatifidum*. The ordinary form of cell is that shown in fig. 5, but occasionally a specimen was found with one semicell curiously distorted (fig. 6). Several cells were seen which showed this inflation of the basal lobes in one semicell, but none were found with both halves abnormal. This appears to be the same as the var. *inflata* of *M. oscitans* Ralfs described by Wolle.<sup>11</sup> If so his form can hardly be called a distinct variety, since we should then have specimens, one half of which was typical, while the other belonged to the variety. The most we can say is that the frond sometimes varies, with the lateral lobes inflated and produced slightly at the angles.

A species which proved in some respects the most interesting of all those studied was *M. furcata* Ag. This is one of the best known species in the genus, having been described by Agardh<sup>12</sup> in 1827. It is a form which is widely distributed, and has been many times described, yet some interesting peculiarities seem to have been unnoticed. The typical form of the species is shown in figs. 7 and 8. The former is from a Long Island specimen, while the other was collected on the other side of the Sound in Connecticut, but not fifty miles distant. One peculiarity of Connecticut specimens was their small size. The average diameter of thirty specimens measured was  $120\mu$ , the extreme measurements being  $108\mu$  and  $132\mu$ . De Toni<sup>13</sup> gives  $113-205\mu$  as the range of variation of the species. The Long Island specimens were larger, the typical ones averaging  $133\mu$ , with extremes of 120 and

<sup>10</sup>Phycologia Germanica 134. 1845.

<sup>11</sup>Bulletin of Torrey Botanical Club. 6: 122.—8: pl. 6. f. 5. 1881.

<sup>12</sup>Flora 10: 643. 1827.

<sup>13</sup>Sylloge Algarum omnium hucusque cognitarum. 1: 1114. 1889.

156 $\mu$ . In another respect the latter are remarkable. The typical form, as is well known, has each of the four lateral lobes deeply bifid, but such specimens are not numerous in this material. The cell shows a decided tendency toward a form with simple lobes (fig. 14). Scores of specimens were examined of which no record was made, but of thirty taken at random which were measured, eleven were typical, two had one simple lobe, five had two, two had three and the same number four, three had but two typical lobes each, three had but one, while two were of the form shown in fig. 14, with all the lobes simple. Some of these varieties are shown in figs. 9-13. Sometimes all the abnormal lobes are in one semicell, while the other is normal, but quite as often some lobes of each are simple, and these may be on the same or opposite sides of the frond. A curious and rather puzzling fact is that the lobes nearest the base of the semicell show the greatest tendency to this variation. If there are not more than four simple lobes these are almost invariably the basal ones. Only one exception to this was found among all the specimens examined.

Another noteworthy fact is that the abnormal forms are almost invariably larger than the typical. Of the thirty specimens measured the eleven typical ones averaged 133 $\mu$ , while the others averaged 163, and the average of those having over four simple lobes was 182, with extremes of 165 and 200 $\mu$ . Only two abnormal specimens measured less than 140 $\mu$ . Often the difference could be seen in a single cell, the varying half being decidedly larger than the other.

In the material collected in Connecticut, only a week or two after the former collection, these variations were very infrequent, but they were found occasionally. Of thirty specimens all but three were of the typical form. Of the three, one showed one semicell of the typical form, while the other was of the extreme form, with all the lobes simple.

Turner has described and figured a variety *decurta*<sup>14</sup> of *M. furcata* Ralfs which seems to be this simple form. He says of it that it is "a strange and apparently abnormal form. Only two semicells seen, of which one possessed a curious double lobelet." His material was from Watertown, N. Y.

It is hardly necessary to call attention to the close re-

<sup>14</sup>On some new and rare desmids. Jour. Royal Micr. Soc. 5: 936. pl. 16. f. 10. 1885.

semblance between the simplest form here described and Mr. Wolle's description and figure<sup>15</sup> of *M. pseudofurcata*. The chief distinction given by him for this species is that it has "only half as many lateral arms" as *M. furcata*. The original figure of *M. pseudofurcata* Wolle, in the Bulletin of the Torrey Botanical Club is almost exactly like fig. 14, and probably represents the same form.

In this connection it is of interest to note Wolle's description of *M. furcata* var. *simplex*.<sup>16</sup> From this it will be seen that he collected and examined in Florida a series of forms showing all possible gradations from a form with two simple lateral arms on each side to one with but one simple lobe on each side of the semicell. He himself calls attention to the resemblance of the former to *M. pseudofurcata* Wolle, and says that it needs further examination.

Combining these facts it seems to the writer that we are justified in no longer recognizing *M. pseudofurcata* Wolle as a distinct species, since a whole series of forms has been found connecting it with *M. furcata* Ag. while the Florida forms described by Wolle connect it with the simple three lobed form. The varieties, *decurta* Turner, and *simplex* Wolle, simply represent forms in this series of variations, and not true varieties. We must then regard *M. furcata* Ag., as an extremely variable species, and our description must be modified to include forms with the lateral lobes two or four, simple or bifid.

No cause could be discovered for the greater variability of the Long Island specimens unless it may be the lower temperature of the water, the Connecticut specimens being from a shallow pool, where the water was quite warm. The larger size of the Long Island forms would perhaps indicate better conditions for vigorous growth.

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#### EXPLANATION OF PLATE VI.

(All figures reduced one-sixth in engraving.)

Fig. 1. Portion of a filament of *Micrasterias foliacea* Bailey.  $\times 200$ .—Fig. 2. Single cell of same.  $\times 400$ .—Fig. 3. Vertical view of frond, showing form of terminal lobe.  $\times 400$ .—Fig. 4. Series of three cells, showing manner of joining.  $\times 400$ .—Fig. 5. *Micrasterias pinnatifida* (Kütz.) Ralfs.  $\times 400$ .—Fig. 6. Same, showing abnormal semicell.  $\times 400$ .—Fig. 7. *Micrasterias furcata* Ag., typical form: Long Island.  $\times 160$ .—Fig. 8. Same, Connecticut.  $\times 160$ .—Fig. 9-13. *M. furcata* Ag. showing variations.  $\times 160$ .—Fig. 14. Same; form with lateral lobes all simple.  $\times 160$ .

<sup>15</sup>Bulletin of Torrey Botanical Club. 12: pl. 51. f. 6, 7. 1885.

<sup>16</sup>Freshwater algæ of the United States 40. pl. 59. f. 6, 7. 1887.